

Development and Flight-Testing of a High-Performance Electric-Pump Fed Launch Vehicle

Completed Technology Project (2017 - 2020)



Project Introduction

Ventions, LLC is proposing use of a liquid-bipropellant (LOX / RP-1), electric-pump fed, 2-stage launch vehicle for low-cost and on-demand ground launch of small payloads initially in the 20-40kg size class (and ultimately up to 100kg) to 250-750km low earth orbits. The proposed launch vehicle uses components matured over 10+ years under DARPA and NASA funded projects, and is realized by a small entrepreneurial team using several key technologies such as regeneratively-cooled, electric-pump fed engines, low-cost and high-performance avionics, lightweight metal tanks, and a host of other custom valves and plumbing components critical for enabling high propellant mass fraction stages at the relevant size class. The proposing team is uniquely positioned to execute and successfully deliver on such a capability based on DARPA and NASA sponsored investment into key enabling technologies and processes for a smaller "pathfinder" launch vehicle. Specifically, as part of DARPA's SALVO (Small Air-Launched Vehicle to Orbit) and ALASA (Airborne Launch Assist Space Access) programs, Ventions has already developed and ground / flight-tested many of the core building blocks necessary for the larger launch vehicle proposed herein, and gained operational experience working with several launch ranges including the Reagan Test Site in Kwajalein, the 30th Space Wing at Vandenberg Air Force Base, the 45th Space Wing at Cape Canaveral, and NASA's Wallops Flight Facility. Additionally, the proposed effort will leverage significant private capital to supplement NASA funds and complete all elements building up to a flight demonstration, including design, component fabrication / assembly / integration, and finally, stage-level ground testing prior to the orbital launch attempt. Successful demonstration of the proposed capability is not only expected to accelerate the development of commercial capabilities to enable frequent launch of small spacecraft to LEO at a cost per kilogram of payload much lower than currently available, but will also serve key government / military needs of a variety of NASA and OGA customers including SMDC, NRO, SOCOM, ORS and DARPA.

Anticipated Benefits

Successful demonstration of the capability is not only expected to accelerate the development of commercial capabilities to enable frequent launch of small spacecraft to LEO (low earth orbit) at a cost per kilogram of payload much lower than currently available, but will also serve key government / military needs of a variety of NASA and OGA (other government agencies) customers including SMDC, NRO, SOCOM, ORS and DARPA. These solicitations increase focus on collaborations with the commercial space sector that not only leverage emerging markets and capabilities to meet NASA's strategic goals, but also focus on industry needs. NASA's investments in industry partnerships can accelerate the availability of, and reduce costs for the development and infusion of, these emerging space system capabilities. While developing the technology to enable NASA's next generation of science and human exploration missions, we will grow the economy and strengthen the nation's



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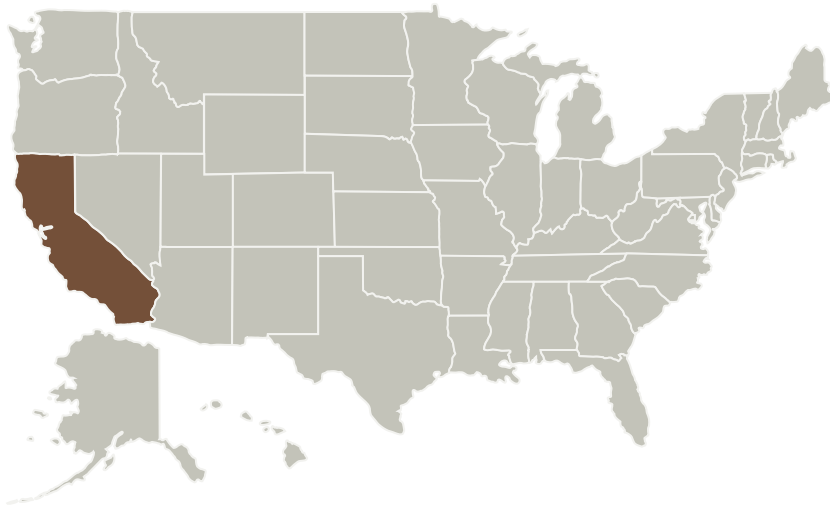
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economic competitiveness.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Ventions, LLC	Lead Organization	Industry	San Francisco, California

Primary U.S. Work Locations

California

Project Transitions



June 2017: Project Start



September 2020: Closed out

Closeout Summary: Astra will provide a full launch vehicle integration and orbital flight test demonstration of a two-stage launch vehicle. The goal is a launch vehicle capable of on-demand ground launch of small payloads to LEO. The launch vehicle was successfully tested in September, 2020.

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Ventions, LLC

Responsible Program:

Flight Opportunities

Project Management

Program Director:

Christopher E Baker

Program Manager:

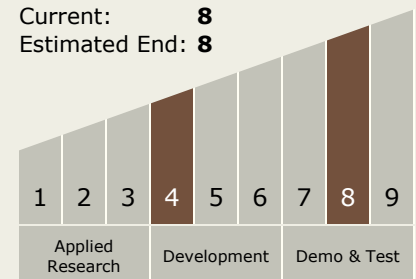
John W Kelly

Principal Investigator:

Adam London

Technology Maturity (TRL)

Start: **4**
Current: **8**
Estimated End: **8**



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Project Website:

<https://www.nasa.gov/directorates/spacetech/home/index.html>

Target Destination

Earth